APPENDIX 'A'

GEOTECHNICAL REPORT

Quality Engineering | Valued Relationships

Morrison Hershfield

Kenaston Blvd Southbound Widening Project
Sub-Surface Investigation

Prepared for:

Morrison Hershfield
25 Scurfield Blvd, Unit 1
Winnipeg, MB R3Y 1G4
Attention: Ron Bruce

Distribution:

Ron Bruce, P.Eng.

Project Number:
0035-048-00

Date:
April 13, 2017

www.trekgeotechnical.ca
1712 St. James Street | Winnipeg, Manitoba R3H 0L3 | Tel 1.204.975.9433 | Fax 1.204.975.9435

TREK GEOTECHNICAL Quality Engineering | Valued Relationships

April 13, 2017 Our File No. 0035-048-00

Ron Bruce, P.Eng.
Morrison Hershfield
59 Scurfield Blvd, Unit 1
Winnipeg, MB R3Y 1V2

RE: Kenaston Blvd Southbound Widening
Sub-Surface Investigation Report

TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the Kenaston Blvd Southbound Widening Project.

Please contact the undersigned if you have any questions. Thank you for the opportunity to serve you on this assignment.

Sincerely,

TREK Geotechnical Inc.
Per:

Nelson John Ferreira, Ph.D., P. Eng.
Geotechnical Engineer, Principal
Tel: 204.975.9433 ext. 103

cc: Shane Broderick, Assistant Lab and Field Services Manager., (TREK Geotechnical)

Revision History

Revision No.	Author	Issue Date	Description
0	SGB	April 13, 2017	Final Report

Authorization Signatures

Prepared By:

Shane Broderick

Shane Broderick, Assistant Lab and Field Services Manager.

Reviewed By:

PROVINCE OF MANITOBA
FERREIRA
Member
22892
REGISTERED PROFESSIONAL ENGINEER
Apr 13, 2017

Nelson John Ferreira, Ph.D., P.Eng.
Geotechnical Engineer

APEGM
Certificate of Authorization
Trek Geotechnical Inc.
No. 4877 Date: Apr. 13, 2017

Table of Contents

List of Figures

List of Appendices

1.0 Introduction

This report summarizes the results of the sub-surface investigation completed for the Kenaston Street Rehabilitation Project The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure.

2.0 Sub-Surface Investigation and Laboratory Program

A total of eight (8) test holes were drilled along Kenaston street between Scurfield boulevard and Kleyson drive. The test holes were drilled at a 50 to 125 m spacing at the locations shown in Figure 01 to a depth of 3.1 m. The test holes were drilled to determine sub-surface conditions for the road upgrades.

The sub-surface investigation was conducted on March 23, 2017. The test holes were drilled by Paddock Drilling Ltd. using their Acker MP8 truck mounted drill rig equipped with 125 mm diameter solid stem augers. The pavement structure (asphalt or concrete) was cored by Paul Bevel of Trek Geotechnical, using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bit. The sub-surface conditions were observed during drilling and visually classified by Shane Broderick of TREK. Other pertinent information such as groundwater and drilling conditions were also recorded during the drilling. Disturbed (auger cuttings) samples retrieved during the sub-surface investigation were transported to TREK's material testing laboratory for further testing. Core samples were also retrieved and logged at TREK's material testing laboratory.

The laboratory testing program consisted of moisture content determination, Atterberg limits, and grain size analysis (mechanical sieve and hydrometer methods) on selected samples. Information gathered is included in a separate appendix (Appendix A). The information provided in the Appendix includes test hole logs, laboratory testing summary tables and results, and photos of the concrete cores.

Test hole locations noted on the test hole logs and shown on Figure 01 are based on a GPS survey conducted by Morrison Hershfield and measured distances from the nearest address, edge of pavement or other permanent features.

3.0 Closure

The geotechnical information provided in this report is in accordance with current engineering principles and practices (Standard of Practice). The findings of this report were based on information provided (field investigation and laboratory testing). Soil conditions are natural deposits that can be highly variable across a site. If subsurface conditions are different than the conditions previously encountered on-site or those presented here, we should be notified to adjust our findings if necessary.

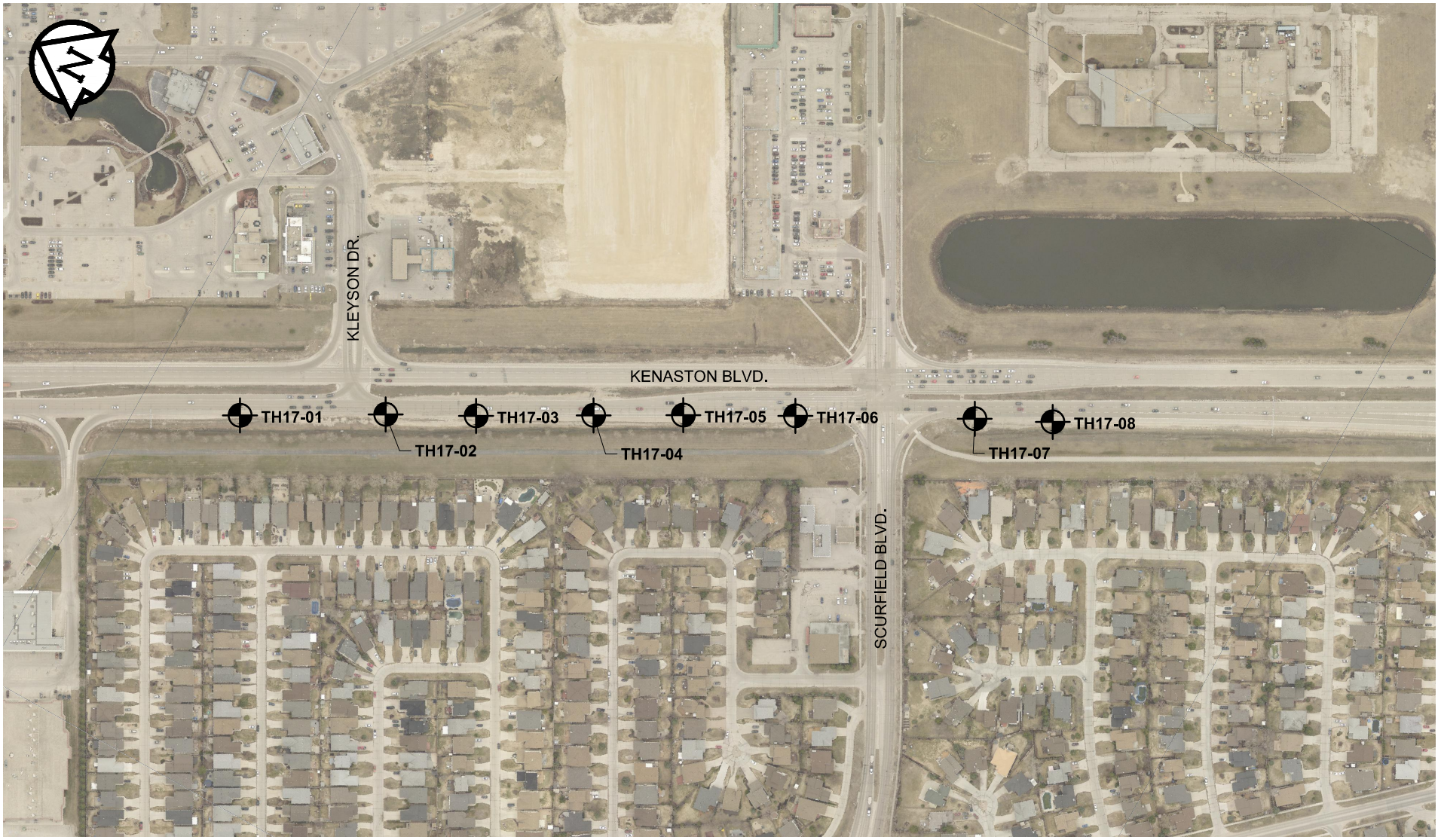
All information provided in this report is subject to our standard terms and conditions for engineering services, a copy of which is provided to each of our clients with the original scope of work, or a mutually executed standard engineering services agreement. If these conditions are not attached, and you are not already in possession of such terms and conditions, contact our office and you will be promptly provided with a copy.

This report has been prepared by TREK Geotechnical Inc. (the Consultant) for the exclusive use of Morrison Hershfield Ltd. (the Client) and their agents for the work product presented in the report. Any findings or recommendations provided in this report are not to be relied upon by any third parties, except as agreed to in writing by the Client and Consultant prior to use.

Figures

TREK GEOTECHNICAL

0035 048 00
City of Winnipeg
South Bound Kenaston Blvd - Third Lane



0 50 100 150 200 m
SCALE = 1 : 4 000 (216 mm x 279 mm)

LEGEND: TEST HOLE (TREK, 2017)

NOTES:
1. IMAGE FROM CITY OF WINNIPEG, 2016.

Figure 01
Test Hole Location Plan

Appendix A

Test Hole Logs

Sub-Surface Log

Test Hole TH17-01
1 of 1

Client:	Morrison Hershfield	**Project Number:**	0035-048-00
Project Name:	Kenaston Blvd Southbound Widening	**Location:**	UTM N-5520083, E-629497
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	234.12 m
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	23 March 2017

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
234.0	0		ASPHALT (110 mm THICK)		
			SAND (FILL) - gravelly (<20 mm dia.), trace clay, trace silt - light brown, frozen, moist when thawed - poorly graded, fine sand to fine gravel - carbonate (limestone) - angular, compact	Grab	G01
	0.5			Grab	G02
233.4			CLAY - silty, trace sand to 0.76 m, trace silt inclusions (<15 mm dia.) - dark green - frozen, moist and firm to stiff when thawed - high plasticity	Grab	G03
	1.0			Grab	G04
				Grab	G05
	1.5				
	2.0			Grab	G06
	2.5				
				Grab	G07
231.1	3.0				
231.1			SILT - some clay, light brown, very soft, moist, low plasticity END OF TEST HOLE AT 3.1 m IN SILT		

Bulk Unit Wt (kN/m^3): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ | ✤ Pocket Pen. ✤ | ☒ Qu ☒ | ○ Field Vane ○

Notes:
1) No sloughing or seepage observed.
2) Test hole backfilled with auger cuttings, bentonite, sand, and cold patch asphalt to surface.
3) Test hole location in the southbound lane, 78.5 m north of the intersection of Kenaston Blvd and Kleyson Drive, 14.3 m west of Kenaston east curb.
4) UTM coordinates and elevation surveyed by Morrison Hershfield.

Logged By: Shane Broderick **Reviewed By:** Paul Bevel **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 20170324 KENASTON SOUTHBOUND WIDENING 0_A_SGBR 0035-048-00.GPJ TREK GEOTECHNICAL.GDT 13/4/17

Sub-Surface Log

Test Hole TH17-02

Client:	Morrison Hershfield	**Project Number:**	0035-048-00
Project Name:	Kenaston Blvd Southbound Widening	**Location:**	UTM N-5519994, E-629548
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	233.63 m
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	23 March 2017

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
233.3	0		SAND (FILL) - gravelly (<20 mm dia.), trace clay, trace silt, mottled reddish ligh to dark brown, frozen, moist when thawed, poorly graded fine sand to fine gravel, carbonate (limestone), angular, compact		G08
	0.5		CLAY (FILL) - silty, trace sand, trace gravel (<20 mm dia.), silt inclusion (<25 mm dia.), trace oxidation - light grey to black - frozen, moist and stiff when thawed - high plasticity		G09
					G10
	1.0				G11
					G12
	1.5				
					G13
231.5	2.0				
			SILT - some clay - light brown - frozen, moist and very soft when thawed - low plasticity		G14
231.0	2.5				
			CLAY - some silt, trace silt inclusions (<20 mm dia.), trace precipitates (<10 mm dia.) - light brown to brown - frozen, moist and stiff when thawed - high plasticity		G15A
230.6	3.0				

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○

0 50 100 150 200 250

END OF TEST HOLE AT 3.1 m IN CLAY

Notes:

1) No sloughing or seepage observed.
2) Test hole backfilled with auger cuttings, bentonite, sand, and cold patch asphalt to surface.
3) Test hole location in the southbound lane, 23.6 m south of the intersection of Kenaston Blvd and Kleyson Drive, 10.8 m west of Kenaston east curb.
4) UTM coordinates and elevation surveyed by Morrison Hershfield.

Logged By: Shane Broderick **Reviewed By:** Paul Bevel **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH17-03
1 of 1

Client:	Morrison Hershfield	**Project Number:**	0035-048-00
Project Name:	Kenaston Blvd Southbound Widening	**Location:**	UTM N-5519938, E-629577
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	233.39 m
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	23 March 2017

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
233.1	0		SAND (FILL) - gravelly (<20 mm dia.), trace clay, trace silt, light brown, frozen, moist when thawed, poorly graded fine sand to fine gravel, carbonate (limestone), angular		G15
	0.5		CLAY (FILL) - silty, trace sand, trace silt inclusions (<20 mm dia.) - mottled dark green to black - frozen, moist and firm to stiff when thawed - high plasticity		G16
232.2	1.0				G17
					G18
	1.5		SILT - clayey, trace sand - light brown to grey - frozen, moist and very soft when thawed - intermediate plasticity		G19
231.3	2.0				G20
			CLAY - silty - light to dark brown - frozen, moist and firm to stiff when thawed - high plasticity		G21
	2.5				
230.3	3.0				G22

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ | ✤ Pocket Pen. ✤ | ☒ Qu ☒ | ○ Field Vane ○

END OF TEST HOLE AT 3.1 m IN CLAY

Notes:
1) No sloughing or seepage observed.
2) Test hole backfilled with auger cuttings, bentonite, sand, and cold patch asphalt to surface.
3) Test hole location in the southbound lane, 87.1 m south of the intersection of Kenaston Blvd and Kleyson Drive, 10.6 m west of Kenaston Blvd east edge of roadway solid white.
4) UTM coordinates and elevation surveyed by Morrison Hershfield.

Logged By: Shane Broderick **Reviewed By:** Paul Bevel **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 20170324 KENASTON SOUTHBOUND WIDENING 0_A_SGBR 0035-048-00.GPJ TREK GEOTECHNICAL.GDT 13/4/17

Sub-Surface Log

Test Hole TH17-04

Client:	Morrison Hershfield	**Project Number:**	0035-048-00
Project Name:	Kenaston Blvd Southbound Widening	**Location:**	UTM N-5519866, E-629618
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	233.20 m
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	23 March 2017

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
233.1	0		ASPHALT (100 mm THICK)		
			SAND (FILL) - gravelly (<20 mm dia.), trace clay, trace silt, light brown, frozen, moist when thawed, poorly graded fine sand to fine gravel, carbonate (limestone), angular, compact		G23
232.9			CLAY (FILL) - silty, trace silt inclusions (<15 mm dia.) to 1.2 m depth - dark green - frozen, moist and firm to stiff when thawed - high plasticity - trace gravel below 0.6 m		G24
	0.5				G25
	1.0				G26
			- mottled brown to black below 1.2 depth		G27
	1.5				
	2.0				
231.1					
231.0			SILT - clayey, trace oxidation, light brown to brown, frozen, moist and very soft when thawed, low plasticity		G28
			CLAY - some silt, trace silt inclusions (<20 mm dia.), trace precipitates (<10 mm dia.) - light to dark brown - frozen, moist and firm to stiff when thawed - high plasticity		G29
	2.5				
					G30
230.2	3.0				

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ | ✤ Pocket Pen. ✤ | ☒ Qu ☒ | ○ Field Vane ○

END OF TEST HOLE AT 3.1 m IN CLAY

Notes:

1) No sloughing or seepage observed.
2) Test hole backfilled with auger cuttings, bentonite, sand, and cold patch asphalt to surface.
3) Test hole location in the southbound lane, 169.6 m north of the intersection of Kenaston Blvd and Kleyson Drive, 9.9 m west of Kenaston Blvd east edge of roadway solid white.
4) UTM coordinates and elevation surveyed by Morrison Hershfield.

Logged By: Shane Broderick **Reviewed By:** Paul Bevel **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH17-05

Client:	Morrison Hershfield	**Project Number:**	0035-048-00
Project Name:	Kenaston Blvd Southbound Widening	**Location:**	UTM N-5519811, E-629648
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	232.94 m
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	23 March 2017

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
232.7	0.0		CONCRETE (235 mm THICK)		
232.5	0.2		SAND (FILL) - gravelly (<20 mm dia.), silty, trace clay, light brown, frozen, moist when thawed, poorly graded fine sand to fine gravel, carbonate (limestone), angular, compact	Grab	G31
	0.5		CLAY (FILL) - silty, trace sand, trace precipitates (<15 mm dia.), trace organics - black - frozen, moist and stiff when thawed - high plasticity	Grab	G32
				Grab	G33
	1.0			Grab	G34
				Grab	G35
	1.5				
	2.0				
230.8	2.1		CLAY - silty, trace gravel, silt inclusions (<20 mm dia.), trace precipitates (<10 mm dia.) - light to dark brown - moist, firm - high plasticity	Grab	G36
	2.5				
229.9	3.0			Grab	G37

Bulk Unit Wt (kN/m^3): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 3.1 m IN SILT

Notes:
1) No sloughing or seepage observed.
2) Test hole backfilled with auger cuttings, bentonite, sand, and cold patch asphalt to surface.
3) Test hole location in the southbound lane, 234.6 m south of the intersection of Kenaston Blvd and Kleyson Drive, 14.3 m west of Kenaston east curb.
4) UTM coordinates and elevation surveyed by Morrison Hershfield.

Logged By: Shane Broderick **Reviewed By:** Paul Bevel **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH17-06

Client:	Morrison Hershfield	**Project Number:**	0035-048-00
Project Name:	Kenaston Blvd Southbound Widening	**Location:**	UTM N-5519742, E-629686
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	232.68 m
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	23 March 2017

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
232.4	0		CONCRETE (240 mm THICK)		
232.2			SAND (FILL) - gravelly (<20 mm dia.), trace clay, trace silt, light brown, frozen, moist when thawed, poorly graded fine sand to fine gravel, carbonate (limestone), angular, compact		G38
	0.5		CLAY (FILL) - silty, trace sand, trace gravel, trace organics - black - frozen, moist and firm to stiff when thawed - high plasticity - trace silt inclusions (<20 mm dia.) below 0.7 m		G39
					G40
	1.0				G41
					G42
	1.5				
	2.0				
230.5					
230.5			SILT - clayey, trace oxidation, trace precipitates (<10 mm dia.), brown, frozen, moist and very soft when thawed, low plasticity		G43
			CLAY - some silt, trace silt inclusions (<20 mm dia.), trace precipitates (<5 mm dia.) - light brown to brown - frozen, moist and firm to stiff when thawed - high plasticity		G44
	2.5				
					G45
229.6	3.0				

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ | ✤ Pocket Pen. ✤ | ☒ Qu ☒ | ○ Field Vane ○

END OF TEST HOLE AT 3.1 m IN CLAY

Notes:

1) No sloughing or seepage observed.
2) Test hole backfilled with auger cuttings, bentonite, sand, and cold patch asphalt to surface.
3) Test hole location in the southbound lane, 311.3 m south of the intersection of Kenaston Blvd and Kleyson Drive, 17.1 m west of Kenaston east curb.
4) UTM coordinates and elevation surveyed by Morrison Hershfield.

Logged By: Shane Broderick **Reviewed By:** Paul Bevel **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH17-07
1 of 1

Client:	Morrison Hershfield	**Project Number:**	0035-048-00
Project Name:	Kenaston Blvd Southbound Widening	**Location:**	UTM N-5519631, E-629746
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	232.64 m
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	23 March 2017

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
232.4	0		CONCRETE (215 mm THICK)		
231.7	0.5		SAND (FILL) - gravelly (<20 mm dia.), trace clay, trace silt - light brown - frozen, moist when thawed - poored graded fine sand to fine gravel - carbonate (limestone) - angular, compact	G	G46
				G	G47
				G	G48
230.7	1.0		CLAY (FILL) - silty, trace sand, trace gravel - mottled light brown to dark brown - frozen, moist and firm when thawed - high plasticity	G	G49
	1.5			G	G50
230.5	2.0		SILT - clayey, trace oxidation, light brown, frozen, moist to wet and very soft when thawed, low plasticity	G	G51
			CLAY - some silt, trace silt inclusions (<20 mm dia.), trace precipitates (<5 mm dia.) - light brown to brown - frozen, moist and firm to stiff when thawed - high plasticity	G	G52
	2.5				
229.6	3.0			G	G53

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100
PL MC LL: 0 20 40 60 80 100
Undrained Shear Strength (kPa): 0 50 100 150 200 250
Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 3.1 m IN CLAY

Notes:
1) No sloughing or seepage observed.
2) Test hole backfilled with auger cuttings, bentonite, sand, and cold patch asphalt to surface.
3) Test hole location in the southbound lane, 437.2 m north of the intersection of Kenaston Blvd and Kleyson Drive, 11.9 m west of Kenaston Blvd east edge of roadway solid white.
4) UTM coordinates and elevation surveyed by Morrison Hershfield.

Logged By: Shane Broderick **Reviewed By:** Paul Bevel **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 20170324 KENASTON SOUTHBOUND WIDENING 0_A_SGBR 0035-048-00.GPJ TREK GEOTECHNICAL.GDT 13/4/17

Sub-Surface Log

Test Hole TH17-08

Client:	Morrison Hershfield	**Project Number:**	0035-048-00
Project Name:	Kenaston Blvd Southbound Widening	**Location:**	UTM N-5519582, E-629770
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	232.90 m
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	23 March 2017

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
232.8	0		ASPHALT (120 mm THICK)		
	0.5		SAND (FILL) - gravelly (<20 mm dia.), trace clay, trace silt - light brown - frozen, moist when thawed - poorly graded, fine sand to fine gravel - carbonate (limestone) - angular, compact		G54
					G55
232.0					G56
	1.0		CLAY (FILL) - silty, some sand, trace gravel - light to dark brown - frozen, moist and firm when thawed - high plasticity		G57
	1.5		- mottled dark brown to dark green below 1.2 m		G58
230.8	2.0				
230.7			SILT - clayey, trace silt inclusions (<10 mm dia.), trace oxidation, brown, frozen, moist to wet and very soft when thawed, low plasticity		G59
	2.5		CLAY - some silt, precipitates (<10 mm dia.) - light to dark brown - frozen, moist and firm to stiff when thawed - high plasticity		G60
229.9	3.0				G61

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○

0 50 100 150 200 250

END OF TEST HOLE AT 3.1 m IN CLAY

Notes:

1) No sloughing or seepage observed.
2) Test hole backfilled with auger cuttings, bentonite, sand, and cold patch asphalt to surface.
3) Test hole location in the southbound lane, 492.0 m north of the intersection of Kenaston Blvd and Kleyson Drive, 14.1 m west of Kenaston Blvd east edge of roadway solid white.
4) UTM coordinates and elevation surveyed by Morrison Hershfield.

Logged By: Shane Broderick **Reviewed By:** Paul Bevel **Project Engineer:** Nelson Ferreira

Appendix B

Lab Testing Summary and Lab Testing Results – Kenaston Street

Local Street Renewal (Kenaston Street)
Sub-Surface Investigation
Summary Table

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid	Plastic	Plasticity Index
TH17-01	U14 (5520083m N, 629497m E) 78.5 m north of the intersection of Kleyson Drive and Kenaston Blvd, southbound lane, 14.3 m west of east curb	Asphalt	110						-							
						SAND FILL (limestone)	0.1	0.4	6.2							
						SAND FILL (limestone)	0.4	0.7	22.1							
						CLAY FILL	0.7	0.9	35.4							
						CLAY FILL	0.9	1.2	34.9							
						CLAY FILL	1.2	1.5	32.5							
						CLAY FILL	2.1	2.4	30.5							
						CLAY	2.7	3.0	41.5							
TH17-02	U14 (5519994m N, 629548m E) 23.6 m south of the intersection of Kleyson Drive and Kenaston Blvd, southbound lane, 10.9 m west of east curb															
						SAND FILL (limestone)	0.0	0.3	6.8							
						CLAY FILL	0.3	0.6	25.5							
						CLAY FILL	0.6	0.9	26.9							
						CLAY FILL	0.9	1.2	29.0							
						CLAY FILL	1.2	1.5	28.5							
						CLAY FILL	1.8	2.1	29.1							
						SILT	2.1	2.4	20.8							
						CLAY	2.7	3.0	44.3							
TH17-03	U14 (5519938m N, 629577m E) 87.1 m south of the intersection of Kleyson Drive and Kenaston Blvd, southbound lane, 10.6 m west of the east edge of roadway whitle solid line															
						SAND FILL (limestone)	0.0	0.3	8.9							
						CLAY FILL	0.3	0.6	24.8							
						CLAY FILL	0.6	0.9	26.5	0	6	47	47	52	20	32
						CLAY FILL	0.9	1.2	29.2							
						CLAY FILL	1.2	1.5	23.3	0	3	65	32	36	16	20
						SILT	1.8	2.1	23.5							
						CLAY	2.1	2.4	42.9							
						CLAY	2.7	3.0	48.0							
TH17-04	U14 (5519866m N, 629618m 169.6 m south of the intersection of Kleyson Drive and Kenaston Blvd, southbound lane, 9.9 m west of the east edge of roadway whitle solid line	Asphalt	100													
						SAND FILL (limestone)	0.1	0.3	5.0							
						CLAY FILL	0.3	0.6	26.9							
						CLAY FILL	0.6	0.9	26.1							
						CLAY FILL	0.9	1.2	23.1							
						CLAY FILL	1.2	1.5	38.5							
						SILT	2.1	2.2	38.7							
						CLAY	2.2	2.4	44.6							
						CLAY	2.7	3.0	53.5							

Local Street Renewal (Kenaston Street)
Sub-Surface Investigation
Summary Table

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid	Plastic	Plasticity Index
TH17-05	U14 (5519811m N, 629649m E) 234.7 m south of the intersection of Kleyson Drive and Kenaston Blvd, southbound lane, 14.4 m west of east curb	Concrete	235													
						SAND FILL (limestone)	0.2	0.4	7.1							
						CLAY FILL	0.4	0.7	25.3							
						CLAY FILL	0.7	0.9	24.9	1	13	30	55	63	22	41
						CLAY FILL	0.9	1.2	25.1							
						CLAY FILL	1.2	1.5	24.2							
						CLAY FILL	2.1	2.4	47.5							
						CLAY FILL	2.7	3.0	50.6							
TH17-06	U14 (5519742m N, 629686m E) 311.3 m south of the intersection of Kleyson Drive and Kenaston Blvd, southbound lane, 17.1 m west of east curb	Concrete	240													
						SAND FILL (limestone)	0.2	0.4	8.3							
						CLAY FILL	0.4	0.7	25.7							
						CLAY FILL	0.7	0.9	26.7							
						CLAY FILL	0.9	1.2	30.7							
						CLAY FILL	1.2	1.5	33.0							
						SILT	2.2	2.3	37.9							
						CLAY	2.3	2.6	50.9							
						CLAY	2.7	3.0	56.6							
TH17-07	U14 (5519631m N, 629745m E) 437.2 m south of the intersection of Kleyson Drive and Kenaston Blvd, southbound lane, 11.9 m west of the east edge of roadway whitle solid line	Concrete	215													
						SAND FILL (limestone)	0.2	0.4	5.4							
						SAND FILL (limestone)	0.4	0.7	3.6							
						SAND FILL (limestone)	0.7	0.9	3.8							
						CLAY	0.9	1.2	22.6	2	15	46	37	43	15	28
						CLAY/SILT	1.2	1.5	22.9							
						SILT	2.0	2.1	38.6							
						CLAY	2.1	2.4	52.7							
						CLAY	2.7	3.0	50.9							
TH17-08	U14 (5519582m N, 629770m E) 492.0 m south of the intersection of Kleyson Drive and Kenaston Blvd, southbound lane, 14.1 m west of the east edge of roadway whitle solid line	Asphalt	120													
						SAND FILL (limestone)	0.1	0.3	7.3							
						SAND FILL (limestone)	0.3	0.6	6.4							
						SAND FILL (limestone)	0.6	0.9	6.9							
						CLAY	0.9	1.2	19.7							
						CLAY	1.2	1.5	34.8							
						SILT	2.1	2.2	37.4							
						CLAY	2.3	2.6	50.4							
						CLAY	2.7	3.0	51.3							

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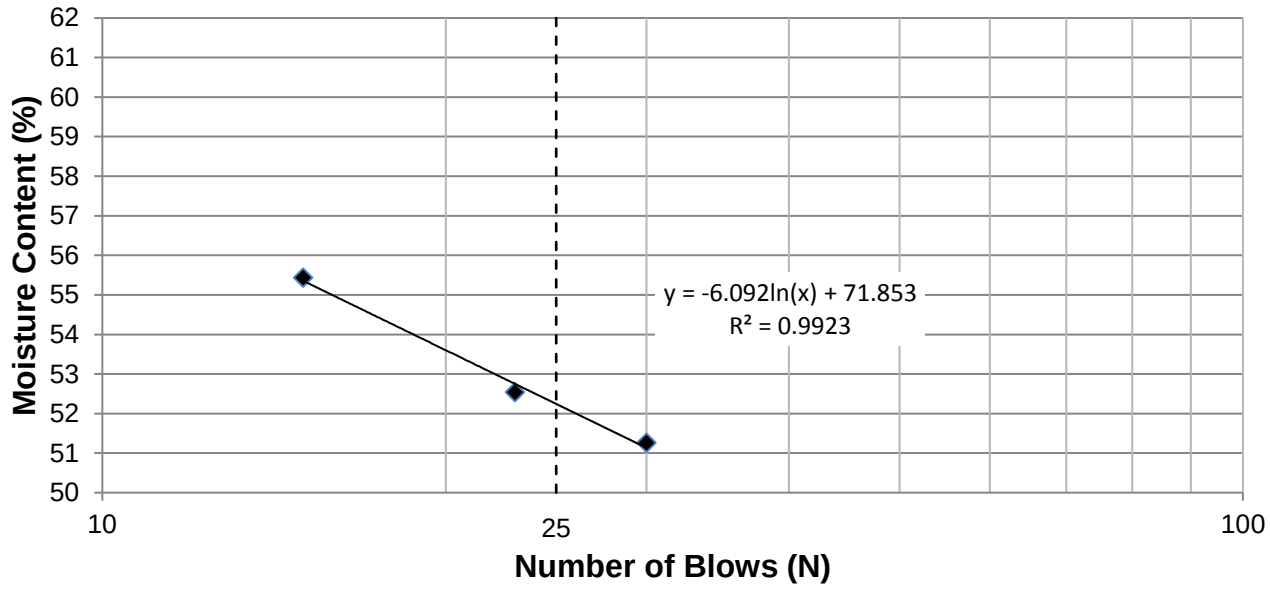
Atterberg Limits
ASTM D4318-10e1

Project No.	0035-048-00
Client	Morrison Hershfield
Project	Kenaston Street Rehabilitation
Test Hole	TH17-03
Sample #	G17
Depth (m)	0.6 - 0.9
Sample Date	23-Mar-17
Test Date	31-Mar-17
Technician	SX

Liquid Limit	52
Plastic Limit	20
Plasticity Index	32

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	15	23	30		
Mass Wet Soil + Tare (g)	24.545	26.283	24.656		
Mass Dry Soil + Tare (g)	20.722	22.182	21.071		
Mass Tare (g)	13.826	14.376	14.078		
Mass Water (g)	3.823	4.101	3.585		
Mass Dry Soil (g)	6.896	7.806	6.993		
Moisture Content (%)	55.438	52.537	51.266		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	21.274	20.962			
Mass Dry Soil + Tare (g)	20.132	19.823			
Mass Tare (g)	14.437	13.980			
Mass Water (g)	1.142	1.139			
Mass Dry Soil (g)	5.695	5.843			
Moisture Content (%)	20.053	19.493			

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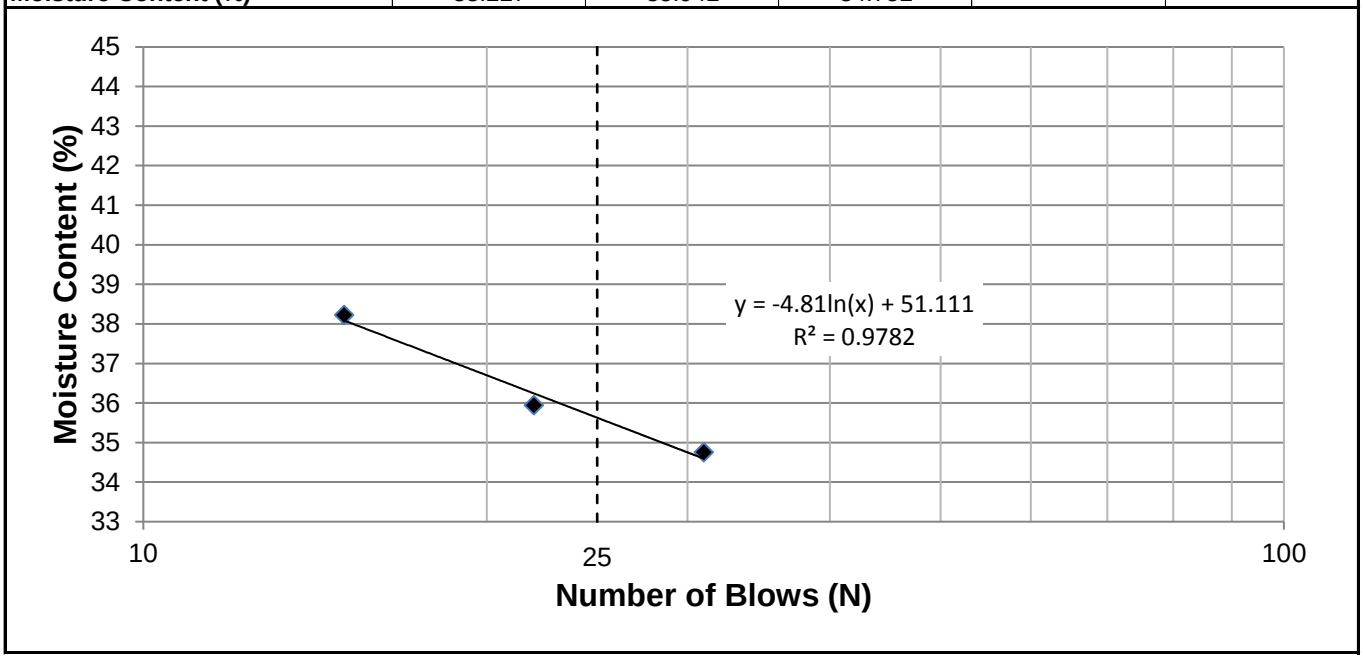
Atterberg Limits
ASTM D4318-10e1

Project No.	0035-048-00
Client	Morrison Hershfield
Project	Kenaston Street Rehabilitation
Test Hole	TH17-03
Sample #	G19
Depth (m)	1.2 - 1.5
Sample Date	23-Mar-17
Test Date	31-Mar-17
Technician	SX

Liquid Limit	36
Plastic Limit	16
Plasticity Index	20

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	15	22	31		
Mass Wet Soil + Tare (g)	27.059	28.850	30.055		
Mass Dry Soil + Tare (g)	23.505	25.034	25.981		
Mass Tare (g)	14.208	14.417	14.258		
Mass Water (g)	3.554	3.816	4.074		
Mass Dry Soil (g)	9.297	10.617	11.723		
Moisture Content (%)	38.227	35.942	34.752		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	19.575	19.913			
Mass Dry Soil + Tare (g)	18.859	19.137			
Mass Tare (g)	14.177	14.290			
Mass Water (g)	0.716	0.776			
Mass Dry Soil (g)	4.682	4.847			
Moisture Content (%)	15.293	16.010			

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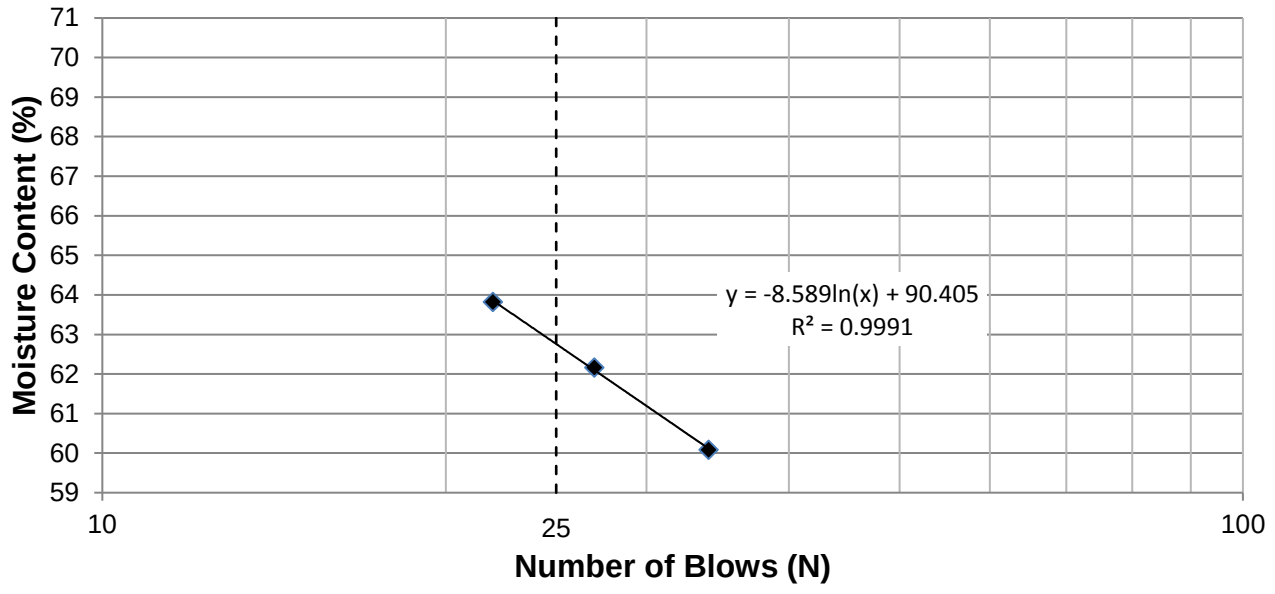
Atterberg Limits
ASTM D4318-10e1

Project No.	0035-048-00
Client	Morrison Hershfield
Project	Kenaston Street Rehabilitation
Test Hole	TH17-05
Sample #	G33
Depth (m)	0.7 - 0.9
Sample Date	23-Mar-17
Test Date	31-Mar-17
Technician	SX

Liquid Limit	63
Plastic Limit	22
Plasticity Index	41

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	22	27	34		
Mass Wet Soil + Tare (g)	26.517	26.401	25.970		
Mass Dry Soil + Tare (g)	21.632	21.737	21.449		
Mass Tare (g)	13.978	14.234	13.925		
Mass Water (g)	4.885	4.664	4.521		
Mass Dry Soil (g)	7.654	7.503	7.524		
Moisture Content (%)	63.823	62.162	60.088		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	19.957	20.881			
Mass Dry Soil + Tare (g)	18.866	19.694			
Mass Tare (g)	13.932	14.078			
Mass Water (g)	1.091	1.187			
Mass Dry Soil (g)	4.934	5.616			
Moisture Content (%)	22.112	21.136			

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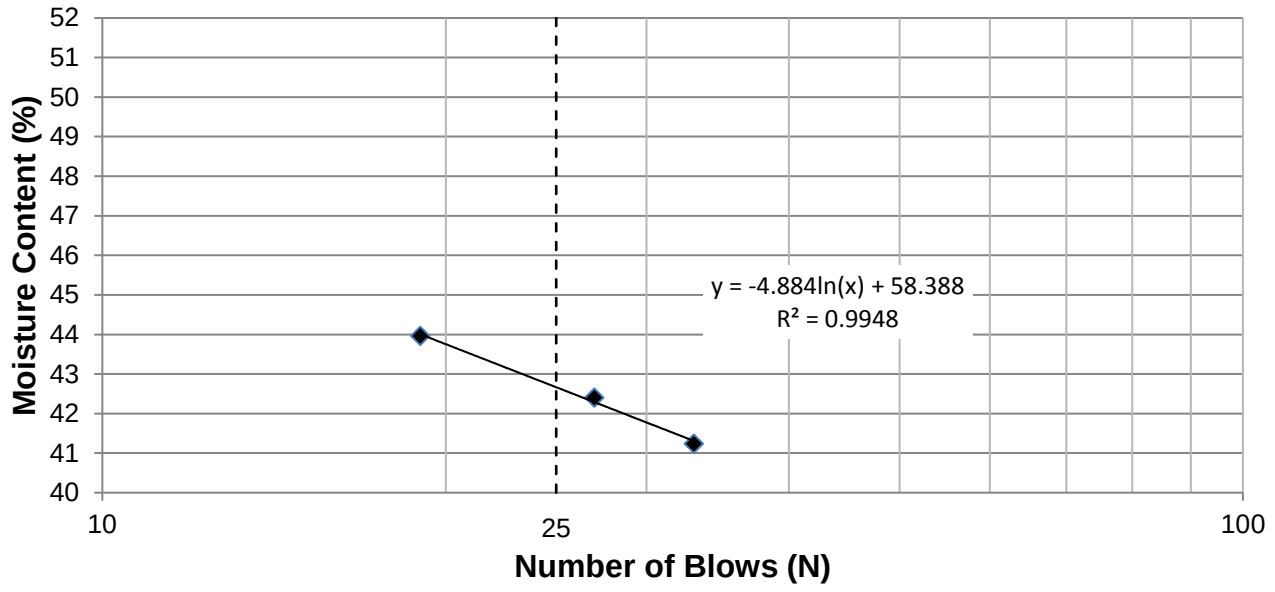
Atterberg Limits
ASTM D4318-10e1

Project No.	0035-048-00
Client	Morrison Hershfield
Project	Kenaston Street Rehabilitation
Test Hole	TH17-07
Sample #	G49
Depth (m)	0.9 - 1.2
Sample Date	23-Mar-17
Test Date	31-Mar-17
Technician	SX

Liquid Limit	43
Plastic Limit	15
Plasticity Index	28

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	19	27	33		
Mass Wet Soil + Tare (g)	25.679	27.473	25.689		
Mass Dry Soil + Tare (g)	22.142	23.547	22.338		
Mass Tare (g)	14.097	14.288	14.212		
Mass Water (g)	3.537	3.926	3.351		
Mass Dry Soil (g)	8.045	9.259	8.126		
Moisture Content (%)	43.965	42.402	41.238		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	20.983	19.388			
Mass Dry Soil + Tare (g)	20.126	18.731			
Mass Tare (g)	14.289	14.246			
Mass Water (g)	0.857	0.657			
Mass Dry Soil (g)	5.837	4.485			
Moisture Content (%)	14.682	14.649			

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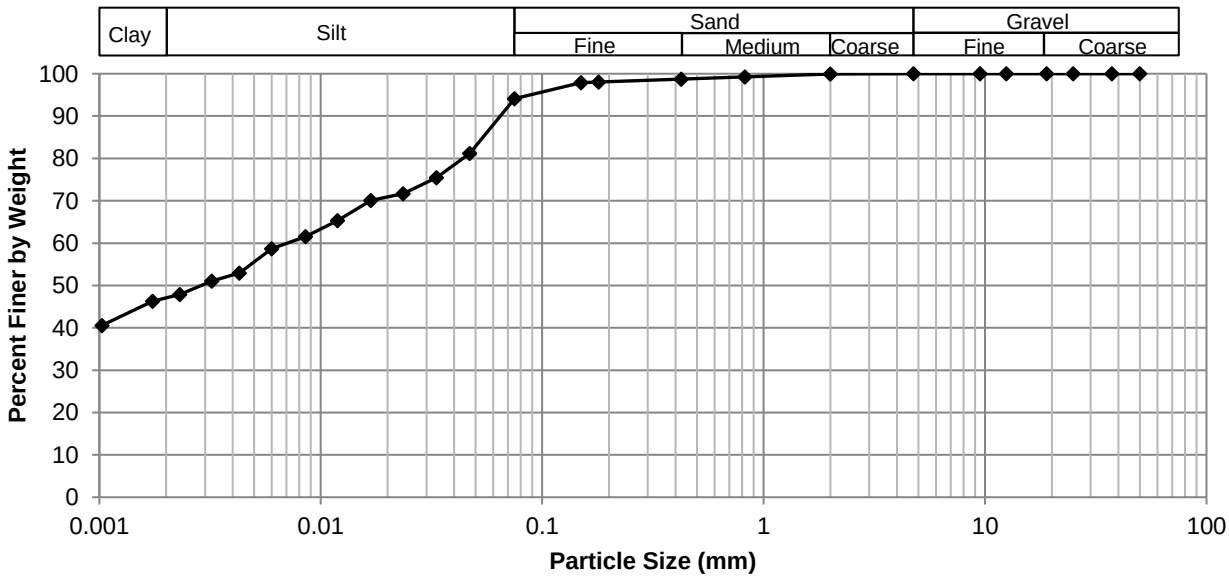
Grain Size Analysis (Hydrometer Method)
ASTM D422

Project No.	0035-048-00
Client	Morrison Hershfield
Project	Kenaston Street Rehabilitation
Test Hole	TH17-03
Sample #	G17
Depth (m)	0.6 - 0.9
Sample Date	23-Mar-17
Test Date	31-Mar-17
Technician	SX

Gravel	0.0%
Sand	5.8%
Silt	47.1%
Clay	47.0%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	**Percent Passing**	**Particle Size (mm)**	**Percent Passing**	**Particle Size (mm)**	**Percent Passing**
50.0	100.00	4.75	100.00	0.0750	94.15
37.5	100.00	2.00	99.91	0.0471	81.19
25.0	100.00	0.825	99.28	0.0333	75.48
19.0	100.00	0.425	98.71	0.0236	71.67
12.5	100.00	0.180	98.03	0.0168	70.09
9.50	100.00	0.150	97.89	0.0119	65.33
4.75	100.00	0.075	94.15	0.0085	61.52
				0.0060	58.67
				0.0043	52.95
				0.0032	51.05
				0.0023	47.88
				0.0017	46.29
				0.0010	40.58

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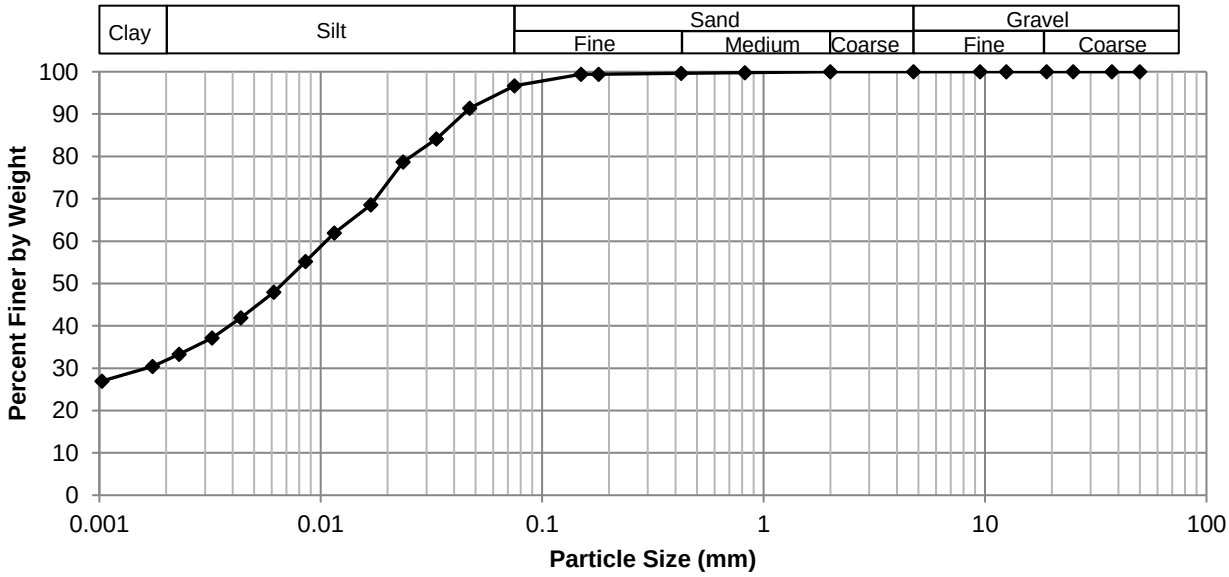
Grain Size Analysis (Hydrometer Method)
ASTM D422

Project No.	0035-048-00
Client	Morrison Hershfield
Project	Kenaston Street Rehabilitation
Test Hole	TH17-03
Sample #	G19
Depth (m)	1.2 - 1.5
Sample Date	23-Mar-17
Test Date	31-Mar-17
Technician	SX

Gravel	0.0%
Sand	3.4%
Silt	64.9%
Clay	31.8%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	**Percent Passing**	**Particle Size (mm)**	**Percent Passing**	**Particle Size (mm)**	**Percent Passing**
50.0	100.00	4.75	100.00	0.0750	96.65
37.5	100.00	2.00	100.00	0.0471	91.43
25.0	100.00	0.825	99.76	0.0333	84.12
19.0	100.00	0.425	99.64	0.0236	78.72
12.5	100.00	0.180	99.43	0.0168	68.56
9.50	100.00	0.150	99.42	0.0115	61.89
4.75	100.00	0.075	96.65	0.0085	55.22
				0.0061	47.92
				0.0044	41.89
				0.0032	37.12
				0.0023	33.31
				0.0017	30.45
				0.0010	26.96

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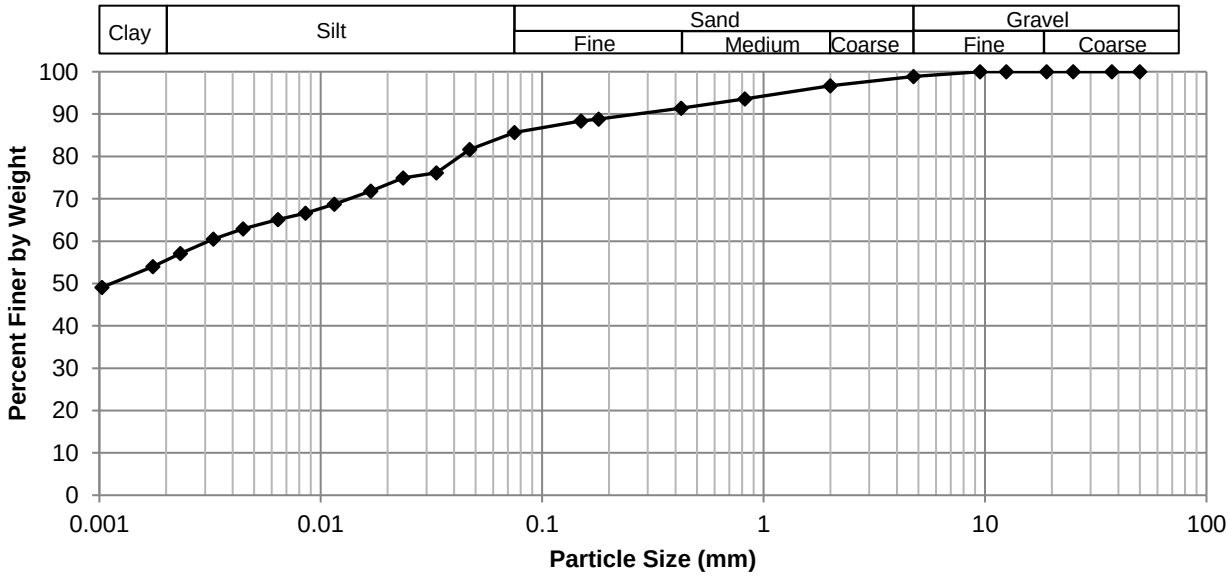
Grain Size Analysis (Hydrometer Method)
ASTM D422

Project No.	0035-048-00
Client	Morrison Hershfield
Project	Kenaston Street Rehabilitation
Test Hole	TH17-05
Sample #	G33
Depth (m)	0.7 - 0.9
Sample Date	23-Mar-17
Test Date	31-Mar-17
Technician	SX

Gravel	1.1%
Sand	13.2%
Silt	30.3%
Clay	55.4%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	**Percent Passing**	**Particle Size (mm)**	**Percent Passing**	**Particle Size (mm)**	**Percent Passing**
50.0	100.00	4.75	98.90	0.0750	85.69
37.5	100.00	2.00	96.70	0.0471	81.66
25.0	100.00	0.825	93.61	0.0333	76.13
19.0	100.00	0.425	91.36	0.0236	74.90
12.5	100.00	0.180	88.80	0.0168	71.83
9.50	100.00	0.150	88.41	0.0115	68.76
4.75	98.90	0.075	85.69	0.0085	66.61
				0.0064	65.07
				0.0045	62.92
				0.0033	60.47
				0.0023	57.09
				0.0017	54.02
				0.0010	49.10

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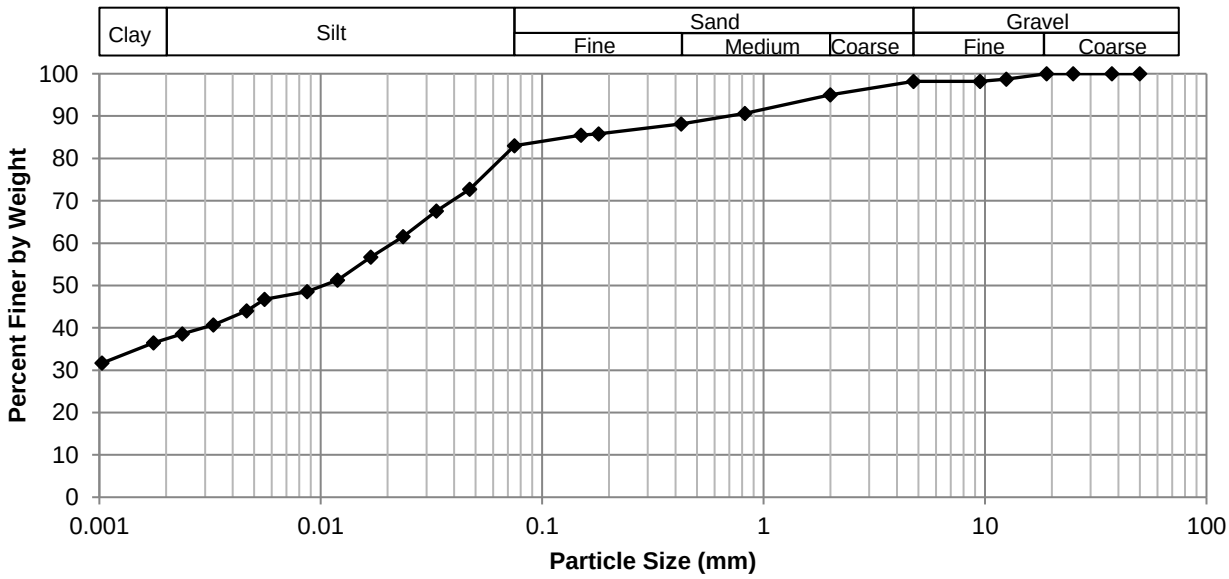
Grain Size Analysis (Hydrometer Method)
ASTM D422

Project No.	0035-048-00
Client	Morrison Hershfield
Project	Kenaston Street Rehabilitation
Test Hole	TH17-07
Sample #	G49
Depth (m)	0.9 - 1.2
Sample Date	23-Mar-17
Test Date	31-Mar-17
Technician	SX

Gravel	1.8%
Sand	15.2%
Silt	45.7%
Clay	37.3%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	**Percent Passing**	**Particle Size (mm)**	**Percent Passing**	**Particle Size (mm)**	**Percent Passing**
50.0	100.00	4.75	98.18	0.0750	83.00
37.5	100.00	2.00	95.06	0.0471	72.72
25.0	100.00	0.825	90.65	0.0333	67.59
19.0	100.00	0.425	88.12	0.0236	61.55
12.5	98.76	0.180	85.81	0.0168	56.72
9.50	98.18	0.150	85.49	0.0119	51.29
4.75	98.18	0.075	83.00	0.0087	48.57
				0.0056	46.76
				0.0046	44.04
				0.0033	40.72
				0.0024	38.61
				0.0018	36.50
				0.0010	31.67

Appendix C

Photographs of Pavement Core Samples

Photo 1: Pavement Core Sample at Test Hole TH17-01

Photo 2: Pavement Core Sample at Test Hole TH17-04

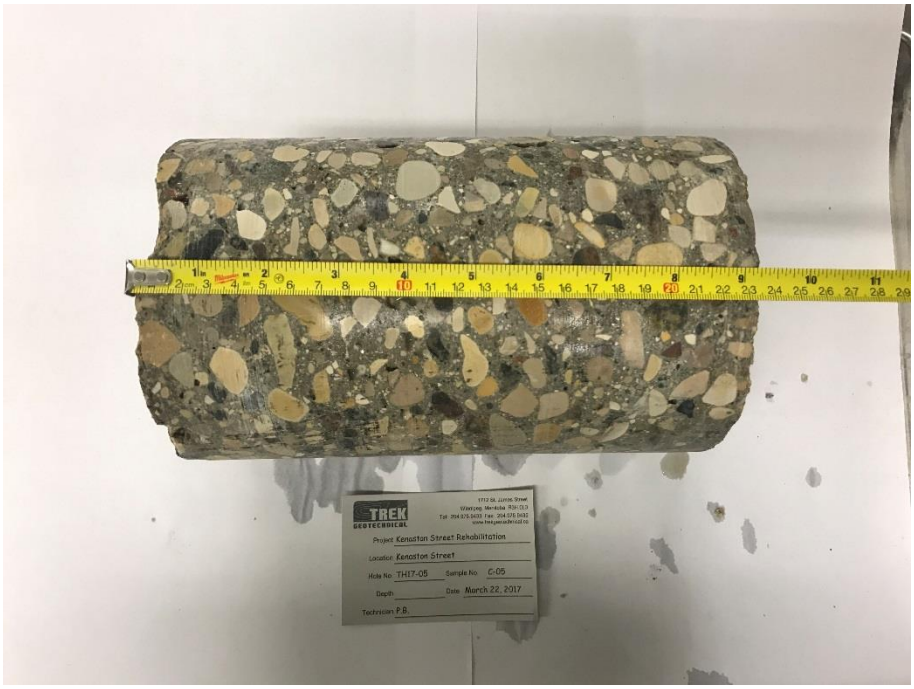


Photo 3: Pavement Core Sample at Test Hole TH17-05

Photo 4: Pavement Core Sample at Test Hole TH17-06

Photo 5: Pavement Core Sample at Test Hole TH17-07

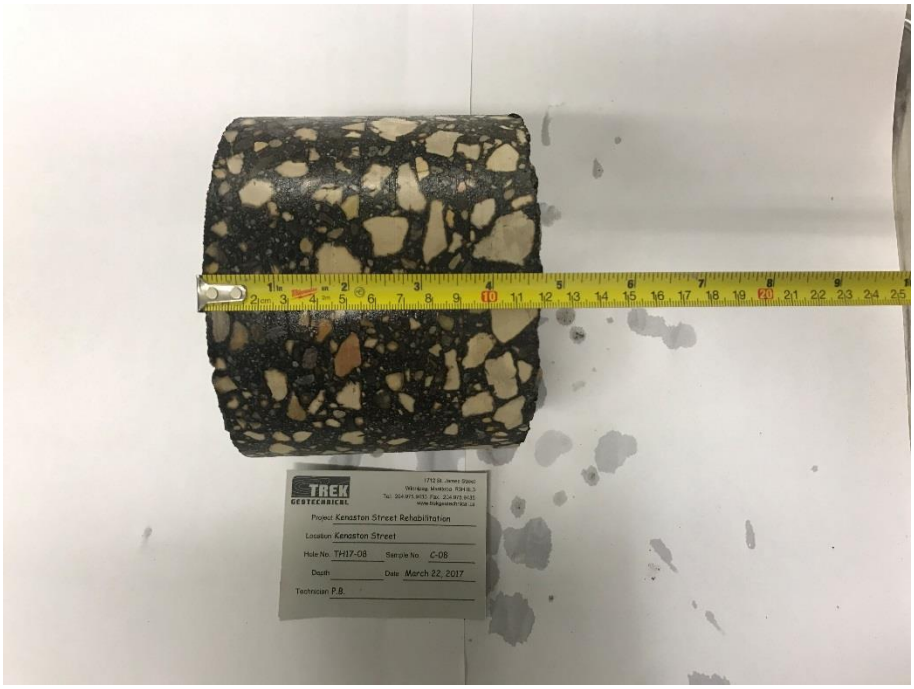


Photo 6: Pavement Core Sample at Test Hole TH17-08